

CONTRIBUTIONS
FROM THE
CUSHMAN LABORATORY
FOR
FORAMINIFERAL RESEARCH

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CUSHMAN LABORATORY FOR FORAMINIFERAL RESEARCH

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These Contributions will be issued quarterly. They will contain short papers with plates, describing new forms and other interesting notes on the general research work on the foraminifera being done on the group by the workers in this laboratory. New literature as it comes to hand will be briefly reviewed.

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CONTRIBUTIONS FROM THE CUSHMAN LABORATORY FOR FORAMINIFERAL RESEARCH

235. EOCENE, MIDWAY, FORAMINIFERA FROM SOLDADO ROCK, TRINIDAD

By JOSEPH A. CUSHMAN and H. H. RENZ

The foraminifera described in this paper originate from the Soldado formation (Midway) of Soldado Rock, a small island which lies in the Serpent's Mouth at the south end of the Gulf of Paria. The rock is situated between the SW. corner of Trinidad, B. W. I. (about 6 miles west of Cedros) and the delta of the Pedernales river in eastern Venezuela.

H. G. Kugler's "The Eocene of the Soldado Rock near Trinidad" (Boletín de Geología y Minería, Vol. II, Nos. 2, 3, and 4, 1938) gives a clear description of the geologic conditions at Soldado Rock. This publication is accompanied by a geologic map, sections, and faunal lists of all the beds. Most of the small-foraminifera described below were collected by Dr. H. G. Kugler in Maury's Bed 3 which forms the highest stratigraphic unit of Midway age below the basal conglomerate (rubble bed) of the upper Eocene (Jacksonian) transgression. The type sample is K. 2950 (for situation see H. G. Kugler's map), a light yellowish-indurated marl which contains besides small foraminifera some Orbitoids described by T. W. Vaughan and W. S. Cole (Preliminary Report on the Cretaceous and Tertiary Larger Foraminifera of Trinidad, B. W. I., Geol. Soc. Amer. Special Paper No. 30, February, 1941). The lithology and fauna of Bed 3 suggest shallow water to reefal depositional conditions.

The Soldado Rock is the only place in Trinidad where small foraminifera have been found in the Soldado formation, although the formation outcrops also at Marac Quarry (South Trinidad). Limestone boulders of Soldado age are known from several places in the San Fernando Area and the Central Range, where they

form components of upper Eocene conglomerates. According to H. G. Kugler the Soldado Rock forms an extension of the Central Range structure of Trinidad.

The samples to which reference is made in the text are stored for reference in the Geological Laboratory of Trinidad Leaseholds, Ltd., Pointe-à-Pierre, Trinidad, B. W. I.

ACKNOWLEDGMENTS

The writers are indebted to the Management of Trinidad Leaseholds, Ltd., to Professor V. C. Illing, the Consulting Geologist of this Company, and especially to Dr. H. G. Kugler, Chief Petroleum Geologist of the "Central Mining and Investment Corp'n., Ltd.," who gave their permission to the publication of this material. We also extend our thanks to Dr. C. M. B. Caudri who made the pencil drawings for the plates.

The Midway foraminifera of the Texas region were described and figured by Mrs. Helen J. Plummer, "Foraminifera of the Midway Formation in Texas" (Univ. Texas Bull. 2644, April, 1927). Many species described there for the first time have now been found to have wide distributions and to be characteristic index fossils for this part of the lower Eocene. Some comparatively large species of the Lagenidae indicate water of considerable depth. The vertical ranges of species in the Texas Midway show that there are several faunas within the Midway that can be distinguished from one another, and the same relationships appear in strata of equivalent age elsewhere.

A similar fauna of Midway Eocene age has been found in Alabama and has been described and figured by J. A. Cushman, "Midway Foraminifera from Alabama" (Contr. Cushman Lab. Foram. Res., vol. 16, pt. 3, 1940). Two distinct beds found in Alabama, called for convenience the Upper and Lower Beds, contain faunas corresponding very definitely with those from the Midway of Texas. Many of the Alabama species are identical with those of Texas but a considerable number of new species are found. This is not surprising as the two areas are far enough distant from one another to allow for differences in geographic and ecologic conditions as well as perhaps some difference in the time element in deposition between the two areas.

The Trinidad material also, while it has numerous species which were described from Texas and some which were described from

Alabama, has numerous new species and varieties. Again this is not surprising as there is a considerable distance between Trinidad and the other localities.

The following species are common to all three of the areas: Texas, Alabama, and Trinidad.

Nodosaria affinis Reuss

Vaginulina plumoides Plummer

Vaginulina robusta Plummer

Globulina gibba d'Orbigny

Siphogenerinoides eleganta (Plummer)

Gyroidina subangulata Plummer

The following species occur both in Texas and Trinidad but did not appear in the faunas from Alabama.

Nonionella soldadoensis n. sp.

Eponides elevata (Plummer)

Pulvinulinella obtusa (Burrows and Holland)

Anomalina acuta Plummer

The following forms occur in Trinidad and Alabama but are not recorded from Texas.

Gaudryina soldadoensis n. sp.

Guttulina sp.

Another interesting connection of the Trinidad fauna is its relationship to the Wilcox Eocene, especially to the Salt Mountain formation of Alabama and the fauna from Ozark, Alabama. A number of species from Trinidad seem to be distinctly related to these, and the same species in most cases are also closely related or identical with species from the middle Eocene of Northern Africa. These relationships are not surprising as it is well known that the Miocene faunas of these widely separated areas are also distinctly related, indicating an open connection between Africa and America at that time.

Family LITUOLIDAE

Genus AMMOMARGINULINA Wiesner, 1931

AMMOMARGINULINA sp. (Pl. 1, fig. 1)

There is a single specimen figured here which has an arenaceous test, the early portion close coiled, and the last-formed chambers uncoiled in a rectilinear series and much compressed. It some-

what resembles *Ammobaculites expansus* Plummer (Univ. Texas Bull. 3201, 1933, p. 65, pl. 5, figs. 4-6) from the Midway of Texas.

Family VERNEUILINIDAE

Genus GAUDRYINA d'Orbigny, 1839

GAUDRYINA SOLDADOENSIS Cushman and Renz, n. sp. (Pl. 1, fig. 2)
Gaudryina sp. CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 16,
 1940, p. 53, pl. 9, fig. 5.

Test somewhat longer than broad, slightly arcuate, early portion triangular and triserial, adult portion biserial, much compressed, the broader faces slightly concave, narrower one deeply so except in the final chamber in the adult; chambers distinct except in the early portion; sutures in the adult strongly depressed; wall finely arenaceous, the exterior slightly roughened; aperture a rounded opening near the inner margin of the last-formed chamber. Length of holotype 1.3 mm.; breadth 0.65 mm.; thickness 0.35 mm.

Holotype (Cushman Coll. No. 38185) from the Midway Eocene, Soldado formation, Soldado Rock, Trinidad, B. W. I. Coll. Dr. H. G. Kugler (sample K. 2950).

The species differs from *G. jacksonensis* Cushman in the slightly arcuate form, greater compression, and more concave sides. It is probably the same as that recorded in the above reference from the Midway of Alabama.

Family MILIOLIDAE

Genus QUINQUELOCULINA d'Orbigny, 1826

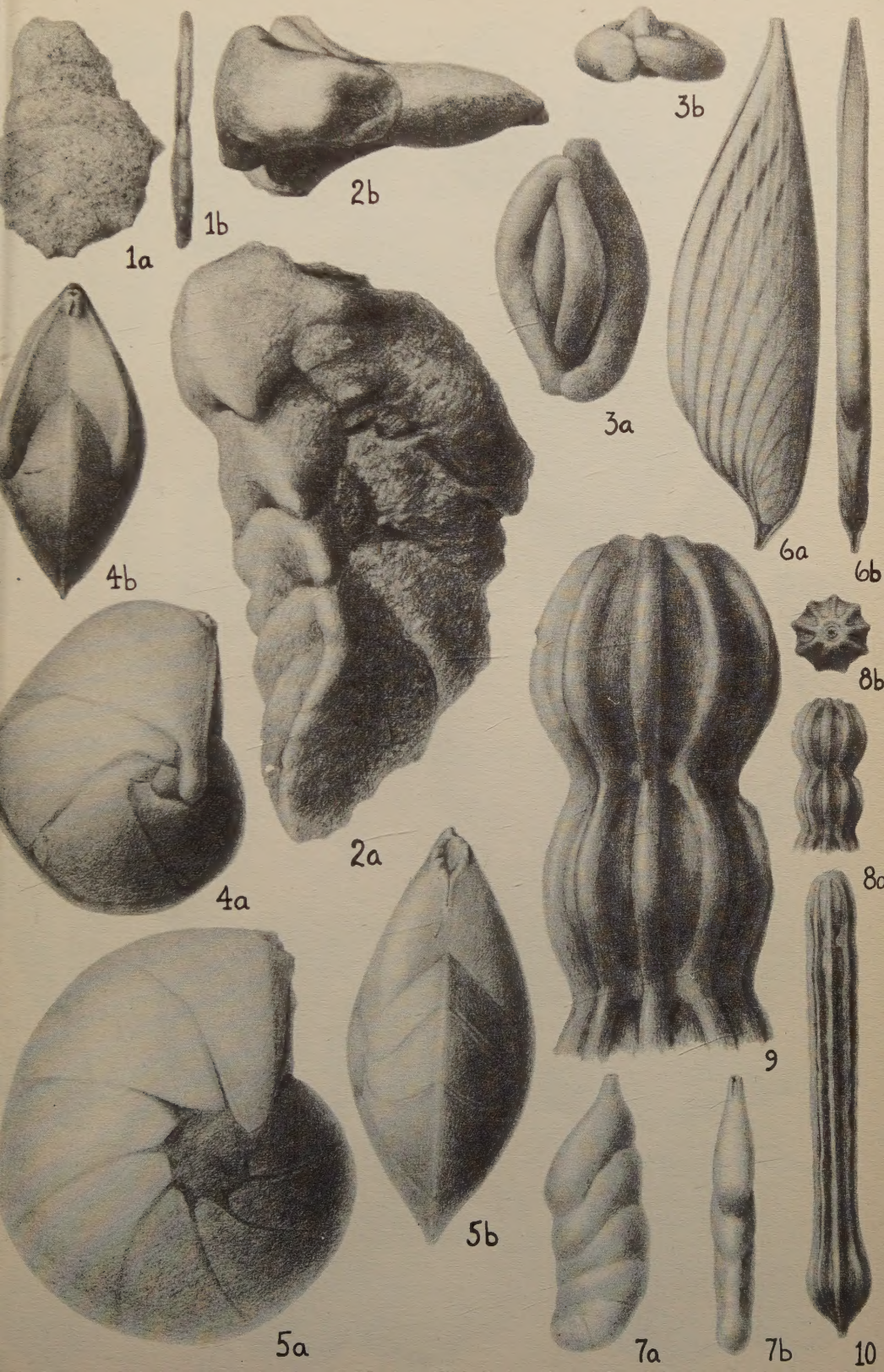
QUINQUELOCULINA sp. (Pl. 1, fig. 3)

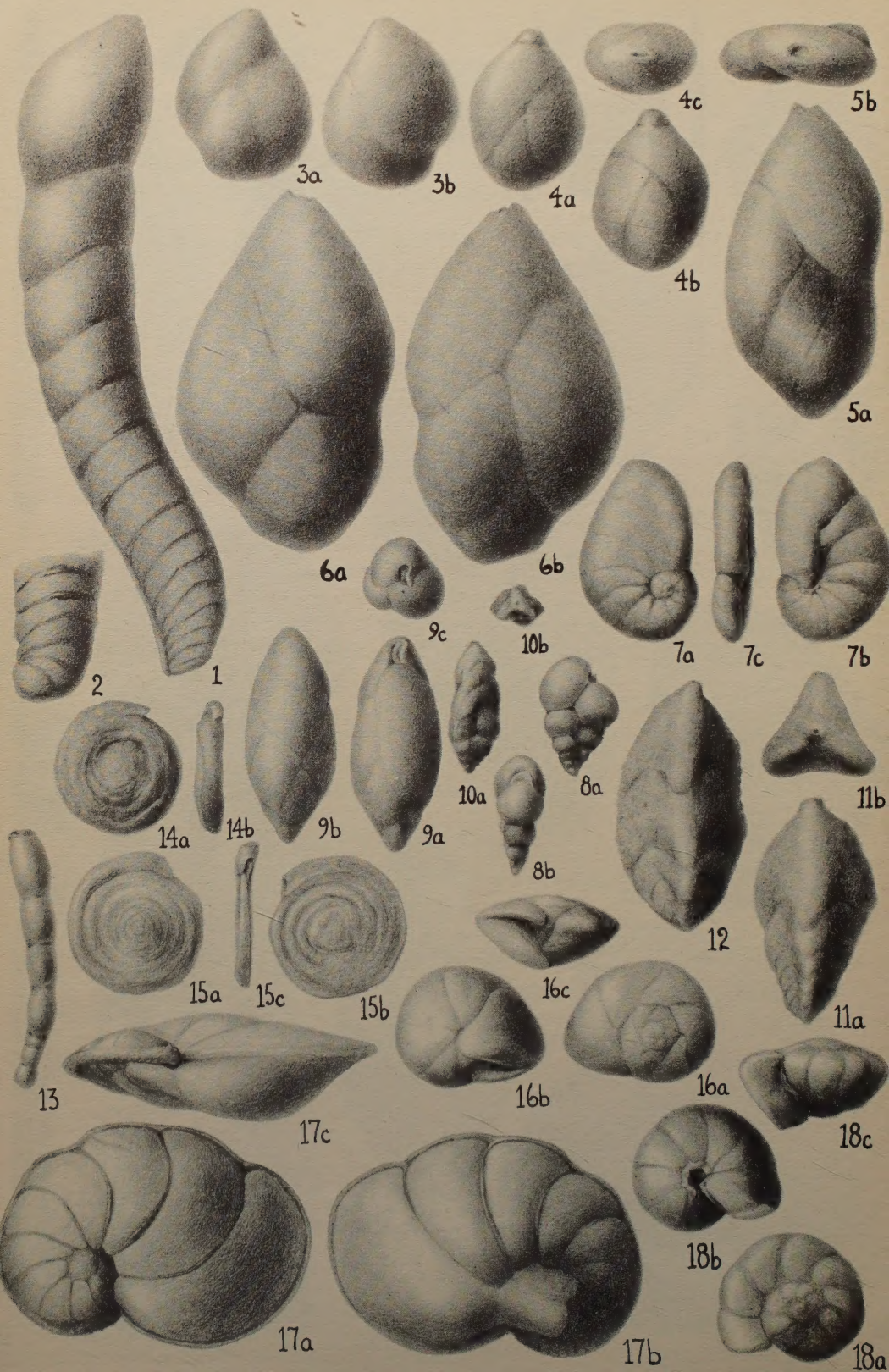
The figured specimen is one of a series of internal casts found in the Soldado material. These casts indicate more than one species present. This is figured for future reference. Miliolidae

EXPLANATION OF PLATE 1

(All figures $\times 70$ except 8 and 10, $\times 20$)

FIG. 1. *Ammomarginulina* sp. a, side view; b, edge view. 2. *Gaudryina soldadoensis* Cushman and Renz, n. sp. Holotype. a, side view; b, apertural view. 3. *Quinqueloculina* sp. a, front view; b, apertural view. 4. *Robulus* cf. *rosetta* (Gümbel). a, side view; b, apertural view. 5. *Robulus* sp. a, side view; b, apertural view. 6. *Vaginulina plumoides* Plummer. a, side view; b, apertural view. 7. *Marginulina* cf. *scitula* (Berthelin). a, side view; b, apertural view. 8-10. *Nodosaria affinis* Reuss. 8 a, 9, side view of megalospheric specimen. 8 b, apertural view. 10, complete megalospheric specimen.





are rare in the Midway as would be expected, for the large number of Lagenidae suggest fairly deep water, a habitat in which Miliolidae do not typically occur.

Family LAGENIDAE

Genus ROBULUS Montfort, 1808

ROBULUS sp. (Pl. 1, fig. 5)

Robulus sp. CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 16, 1940, p. 56, pl. 9, fig. 25.

A few specimens in the Soldado material are similar to that figured in the above reference from the Midway of Alabama. A few of the specimens tend to have raised sutures remotely resembling *R. midwayensis* (Plummer).

ROBULUS cf. ROSETTA (Gümbel) (Pl. 1, fig. 4)

Robulina rosetta GÜMBEL, Abhandl. kön. bay. Akad. Wiss., München, Cl. II, vol. 10, 1870, p. 642, pl. 1, fig. 73.

Robulus rosetta CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 16, 1940, p. 55, pl. 9, fig. 24.

A very few specimens resemble this species but do not have as wide a keel as the Midway specimens from Alabama referred to Gümbel's species.

Genus MARGINULINA d'Orbigny, 1826

MARGINULINA cf. SCITULA (Berthelin) (Pl. 1, fig. 7)

A few specimens from the Soldado resemble the form found in

EXPLANATION OF PLATE 2

(All figures $\times 70$)

FIGS. 1, 2. *Vaginulina robusta* Plummer. 1, side view of nearly complete specimen. 2, basal chambers. 3. *Guttulina* sp. *a*, *b*, opposite sides. 4. *Globulina gibba* d'Orbigny. *a*, *b*, opposite sides; *c*, apertural view. 5. *Sigmomorphina soldadoensis* Cushman and Renz, n. sp. Holotype. *a*, front view; *b*, apertural view. 6. *Pseudopolymorphina* sp. *a*, *b*, opposite sides. 7. *Nonionella soldadoensis* Cushman and Renz, n. sp. Holotype. *a*, dorsal view; *b*, ventral view; *c*, peripheral view. 8. *Gümbelina trinitatensis* Cushman and Renz, n. sp. Holotype. *a*, front view; *b*, side view. 9. *Bulimina kugleri* Cushman and Renz, n. sp. Holotype. *a*, front view; *b*, rear view; *c*, apertural view. 10. *Angulogerina* cf. *parvula* (Cushman and Thomas). *a*, front view; *b*, apertural view. 11, 12. *Trifarina herberti* Cushman and Renz, n. sp. 11, Holotype. *a*, front view; *b*, apertural view. 12, Paratype. 13. *Ellipsonodosaria* sp. 14, 15. *Spirillina* sp. 14 *a*, ventral view; *b*, peripheral view; 15 *a*, dorsal view; *b*, ventral view; *c*, peripheral view. 16. *Pulvinulinella obtusa* (Burrows and Holland). *a*, dorsal view; *b*, ventral view; *c*, peripheral view. 17. *Cancris maurayae* Cushman and Renz, n. sp. Holotype. *a*, dorsal view; *b*, ventral view; *c*, peripheral view. 18. *Gyroidina subangulata* Plummer. *a*, dorsal view; *b*, ventral view; *c*, peripheral view.

the Midway of Alabama and Texas and referred to Berthelin's species. The later chambers in the Trinidad specimens tend to be more inflated and have deeper sutures.

Genus **NODOSARIA** Lamarck, 1812

NODOSARIA AFFINIS Reuss (Pl. 1, figs. 8-10)

This species has already been recorded from the Midway of Alabama and Texas and elsewhere in the Upper Cretaceous and Eocene. A megalospheric specimen from the Soldado is figured. There is considerable variation in this species and the early stages in the megalospheric and microspheric forms are quite different.

Genus **VAGINULINA** d'Orbigny, 1826

VAGINULINA PLUMOIDES Plummer (Pl. 1, fig. 6)

Vaginulina plumoides PLUMMER, Univ. Texas Bull. 2644, 1927, p. 120, pl. 5, fig. 4.—CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 16, 1940, p. 61, pl. 9, fig. 26.

In Texas and Alabama this species seems to be characteristic of the lower part of the Midway. The figured specimen from the Soldado is typical.

VAGINULINA ROBUSTA Plummer (Pl. 2, figs. 1, 2)

Vaginulina robusta PLUMMER, Univ. Texas Bull. 2644, 1927, p. 113, pl. 6, fig. 6.—CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 16, 1940, p. 61, pl. 10, figs. 1-4.

As in the Midway of Texas and Alabama, the Soldado specimens from Trinidad show a considerable amount of variation, especially in the degree of development of the raised costae. The figured specimen is relatively smooth.

Family **POLYMORPHINIDAE**

Genus **GUTTULINA** d'Orbigny, 1839

GUTTULINA sp. (Pl. 2, fig. 3)

A few specimens from the Soldado are similar to the one figured from the Midway of Alabama (Cushman, Contr. Cushman Lab. Foram. Res., vol. 16, 1940, p. 63, pl. 11, fig. 7). They show considerable variation and may possibly be the young stages of the *Pseudopolymorphina* sp. figured here. A larger series of specimens will be necessary to prove these relationships.

Genus *GLOBULINA* d'Orbigny, 1839*GLOBULINA GIBBA* d'Orbigny (Pl. 2, fig. 4)

The specimens figured may be referred to this widely distributed and widely ranging species. It has already been recorded from the Midway of Alabama and Texas.

Genus *PSEUDOPOLYMORPHINA* Cushman and Ozawa, 1928*PSEUDOPOLYMORPHINA* sp. (Pl. 2, fig. 6)

There are but two specimens of this form in the Soldado material, one of which is here figured. They suggest a partially developed stage of the form figured from the Midway of Alabama (Cushman, Contr. Cushman Lab. Foram. Res., vol. 16, 1940, p. 64, pl. 11, fig. 9) where it was also very rare.

Genus *SIGMOMORPHINA* Cushman and Ozawa, 1928*SIGMOMORPHINA SOLDADOENSIS* Cushman and Renz, n. sp. (Pl. 2, fig. 5)

Test about twice as long as broad, the greatest breadth above the middle, strongly compressed, two biserial chambers in the adult making up more than half the test, earlier ones sigmoid; chambers of the last part slightly inflated; sutures distinct, but only slightly depressed in the adult portion; wall smooth; aperture terminal, radiate. Length of holotype 0.60 mm.; breadth 0.30 mm.; thickness 0.15 mm.

Holotype (Cushman Coll. No. 38195) from the Midway Eocene, Soldado formation, Soldado Rock, Trinidad, B. W. I. Coll. Dr. H. G. Kugler (sample K. 2950).

Our species differs from *S. trinitatensis* Cushman and Ozawa in the more elongate form, the broader and shorter adult chambers, and the greatest breadth above the middle.

Family NONIONIDAE

Genus *NONIONELLA* Cushman, 1926*NONIONELLA SOLDADOENSIS* Cushman and Renz, n. sp. (Pl. 2, fig. 7)

Nonionina turgida PLUMMER (not WILLIAMSON), Univ. Texas Bull. 2644, 1927, p. 159, pl. 12, fig. 6.

Test somewhat longer than broad, strongly compressed, periphery rounded, ventral side with the basal portion of the umbilical area covered, in peripheral view with the sides nearly parallel; chambers distinct, slightly inflated on the ventral side, all visible on the dorsal side, on the ventral side with the last-formed chamber extended into a lobe over the umbilical region; sutures dis-

tinct, slightly depressed; wall smooth; aperture extending from the periphery ventrally under the lobe of the last-formed chamber. Length of holotype 0.40 mm.; breadth 0.25 mm.; thickness 0.08 mm.

Holotype (Cushman Coll. No. 38197) from the Midway Eocene, Soldado formation, Soldado Rock, Trinidad, B. W. I. Coll. Dr. H. G. Kugler (sample K. 2951).

Our species differs from *N. jacksonensis* Cushman in the much more compressed test and narrower ventral lobe.

Family HETEROHELICIDAE

Genus GÜMBELINA Egger, 1899

GÜMBELINA TRINITATENSIS Cushman and Renz, n. sp. (Pl. 2, fig. 8)

Test slightly longer than broad, moderately compressed, rapidly tapering, greatest breadth formed by the last-formed pair of chambers, periphery rounded, lobulate; chambers with breadth and height about equal, the last-formed pair in the adult usually much larger than the remainder of the test; sutures distinct, depressed, straight, nearly at right angles to the elongate axis; wall smooth or slightly hispid; aperture high, arched. Length of holotype 0.27 mm.; breadth 0.20 mm.; thickness 0.15 mm.

Holotype (Cushman Coll. No. 38198) from the Midway Eocene, Soldado formation, Soldado Rock, Trinidad, B. W. I. Coll. Dr. H. G. Kugler (sample K. 2950).

This species differs from *G. midwayensis* Cushman from the Midway of Alabama in the larger size, straight sutures, and very large final chambers. In some of our specimens the final chambers are very large, somewhat resembling those of *G. ultimatimida* White.

Genus SIPHOGENERINOIDES Cushman, 1927

SIPHOGENERINOIDES ELEGANTA (Plummer)

Siphogenerina eleganta PLUMMER, Univ. Texas Bull. 2644, 1927, p. 126, pl. 8, fig. 1.

Siphogenerinoides eleganta CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 16, 1940, p. 66, pl. 11, fig. 17.

A single typical specimen occurs in our Soldado material. The species has already been recorded from the Midway of Texas and Alabama.

Family BULIMINIDAE

Genus BULIMINA d'Orbigny, 1826

BULIMINA KUGLERI Cushman and Renz, n. sp. (Pl. 2, fig. 9)

Test elongate, fusiform, about twice as long as broad, greatest breadth at about the middle; chambers distinct, slightly inflated, elongate; sutures distinct, very slightly depressed; wall smooth; aperture a high, arched, slightly curved opening at the base of the inner margin of the last-formed chamber. Length of holotype 0.50 mm.; diameter 0.23 mm.

Holotype (Cushman Coll. No. 38199) from the Midway Eocene, Soldado formation, Soldado Rock, Trinidad, B. W. I. Coll. Dr. H. G. Kugler (sample K. 2950).

Our species differs from *B. quadrata* Plummer in the more distinctly fusiform shape, subacute at the ends, and the high, curved aperture.

This species is dedicated to Dr. H. G. Kugler in recognition of his valuable studies of Soldado Rock geology.

Genus ANGULOGERINA Cushman, 1927

ANGULOGERINA cf. PARVULA (Cushman and Thomas) (Pl. 2, fig. 10)

Rare specimens which seem very close to this species described from the Wilcox Eocene of Texas occur in the Soldado. The shape and ornamentation are very similar.

Genus TRIFARINA Cushman, 1923

TRIFARINA HERBERTI Cushman and Renz, n. sp. (Pl. 2, figs. 11, 12)

Test elongate, about twice as long as broad, triangular in transverse section, sides slightly concave, angles rounded, rapidly tapering in the microspheric form, more fusiform in the megalospheric; chambers few, increasing rapidly in height as added; sutures distinct, depressed, strongly curved upward in the middle of each lateral face; wall smooth; aperture terminal, rounded, at the end of a short, tubular neck. Length 0.50-0.55 mm.; diameter 0.25 mm.

Holotype (Cushman Coll. No. 38201) from the Midway Eocene, Soldado formation, Soldado Rock, Trinidad, B. W. I. Coll. Dr. H. G. Kugler (sample K. 2950).

This species differs from *T. wilcoxensis* (Cushman) in the shorter, broader form and relatively larger adult chambers.

This species is dedicated to Mr. E. D. A. Herbert, Managing Director of Trinidad Leaseholds, Ltd., in recognition of his encouragement of geological research in Trinidad.

Family ELLIPSOIDINIDAE

Genus ELLIPSONODOSARIA A. Silvestri, 1900

ELLIPSONODOSARIA sp. (Pl. 2, fig. 13)

A few incomplete specimens, one of which is figured, occur in the Soldado.

Family ROTALIIDAE

Genus SPIRILLINA Ehrenberg, 1843

SPIRILLINA sp. (Pl. 2, figs. 14, 15)

There are numerous specimens in our Soldado material which are not perfectly preserved and at first glance appear like *Ammodiscus* but show distinct pores and entirely dissolve in weak acid without residue or trace of chitinous lining. The two sides are usually not entirely alike and suggest *Conicospirillina*.

Genus DISCORBIS Lamarck, 1804

DISCORBIS MIDWAYENSIS Cushman, var. SOLDADOENSIS Cushman and Renz, n. var.
(Pl. 3, fig. 4)

Variety differing from the typical in the thicker, more convex test, fewer chambers, deeper umbilical region, narrower, more triangular, and more inflated final chamber.

Holotype of variety (Cushman Coll. No. 38211) from the Midway Eocene, Soldado formation, Soldado Rock, Trinidad, B. W. I. Coll. Dr. H. G. Kugler (sample K. 2950).

There is considerable variation in this form, some of the other specimens having the final chamber broader than in the one figured. These are, however, apparently related to the Midway species described from Alabama.

DISCORBIS MIDWAYENSIS Cushman, var. TRINITATENSIS Cushman and Renz, n. var.
(Pl. 3, fig. 5)

Variety differing from the typical in the ornamentation of the test, consisting of thickened and raised sutures on the dorsal side and deeper sutures on the ventral side.

Holotype of variety (Cushman Coll. No. 38212) from the Midway Eocene, Soldado formation, Soldado Rock, Trinidad, B. W. I. Coll. Dr. H. H. Renz (sample R2. 255).

This appears quite distinct from typical *D. midwayensis* but its main characters, outside those noted above, are very similar.

Genus GYROIDINA d'Orbigny, 1826

GYROIDINA SUBANGULATA Plummer (Pl. 2, fig. 18)

Gyroidina soldanii (D'ORBIGNY), var. *subangulata* PLUMMER, Univ. Texas Bull. 2644, 1927, p. 154, pl. 12, fig. 1.

Cyroidina subangulata CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 16, 1940, p. 71, pl. 12, fig. 7.

Very typical specimens of this Midway species occur in our Soldado material. It has already been recorded from Texas and Alabama.

Genus EPONIDES Montfort, 1808

EPONIDES ELEVATA (Plummer) (Pl. 3, fig. 1)

Truncatulina elevata PLUMMER, Univ. Texas Bull. 2644, 1927, p. 142, pl. 11, fig. 1.

Our specimens have been compared with autotypes of this species from the Midway of Texas and seem to be identical. The species is fairly common in the Soldado material. It was not found in the Midway material from Alabama.

Genus CANCRIS Montfort, 1808

CANCERIS MAURYAE Cushman and Renz, n. sp. (Pl. 2, fig. 17)

Test nearly equally biconvex, periphery subacute and slightly keeled; chambers distinct, about 10 in the final whorl, increasing rather rapidly in size as added, the last two or three making up more than half of the test, slightly inflated; sutures distinct, slightly limbate and raised, especially on the dorsal side; wall smooth; aperture a low slit below the ventral extension of the last-formed chambers. Length of holotype 0.70 mm.; breadth 0.50 mm.; thickness 0.35 mm.

Holotype (Cushman Coll. No. 38206) from the Midway Eocene, Soldado formation, Soldado Rock, Trinidad, B. W. I. Coll. Dr. H. G. Kugler (sample K. 2950).

This species differs from *C. sagra* d'Orbigny in the strongly developed keel and raised sutures. On the ventral side it suggests *Valvulineria*.

This species is dedicated to the late Dr. Carlotta J. Maury, pioneer of West Indian paleontology and in particular an early student of Soldado faunas.

Family CASSIDULINIDAE

Genus PULVINULINELLA Cushman, 1926

PULVINULINELLA OBTUSA (Burrows and Holland) (Pl. 2, fig. 16)

Pulvinulina exigua H. B. BRADY, var. *obtusa* BURROWS and HOLLAND,

Proc. Geol. Assoc., vol. 15, 1897, p. 49, pl. 2, fig. 25.—PLUMMER, Univ. Texas Bull. 2644, 1927, p. 151, pl. 11, fig. 2.

An examination of topotype material collected by the senior author from the Eocene, Thanet Beds, of Pegwell Bay, England, shows that our material as well as that from the Midway of Texas are identical with it. The original figures are not entirely correct but show that it is really a *Pulvinulinella*.

Family GLOBOROTALIIDAE

Genus GLOBOROTALIA Cushman, 1927

GLOBOROTALIA CRASSATA (Cushman), var. **AEQUA** Cushman and Renz, n. var.
(Pl. 3, fig. 3)

Variety differing from the typical in the much smoother surface, and the chambers especially the later ones, broader and more arcuate.

Holotype of variety (Cushman Coll. No. 38210) from the Midway Eocene, Soldado formation, Soldado Rock, Trinidad, B. W. I. Coll. Dr. H. G. Kugler (sample K. 2950).

This is evidently closely related to *G. crassata* (Cushman).

GLOBOROTALIA WILCOXENSIS Cushman and Ponton, var. **ACUTA** Toulmin (Pl. 3, fig. 2)
Globorotalia wilcoxensis CUSHMAN and PONTON, var. *acuta* TOULMIN,
Journ. Pal., vol. 15, 1941, p. 608, pl. 82, figs. 6-8.

Our Soldado specimens seem identical with this variety recently described from the Salt Mountain limestone of Alabama. The peripheral angle is carinate and the chambers are much extended ventrally.

Family ANOMALINIDAE

Genus ANOMALINA d'Orbigny, 1826

ANOMALINA ACUTA Plummer (Pl. 3, fig. 6)

Anomalina ammonoides REUSS, var. *acuta* PLUMMER, Univ. Texas Bull. 2644, 1927, p. 149, pl. 10, fig. 2.

Our figure represents an adult specimen from the Soldado and has been compared with autotypes from the Midway of Texas. The Soldado series shows smaller and less ornamented specimens very much like the Texas ones together with larger, apparently adult specimens, with an increased ornamentation. The whole series seems to belong with one species which is distinct from that of Reuss.

ANOMALINA BASIOBATA Cushman and Renz, n. sp. (Pl. 3, fig. 7)

Test nearly equally biconvex, periphery rounded, central region of each side somewhat depressed, ventral side umbilicate;

chambers about 9 in the adult whorl, increasing gradually and rather regularly in size as added, very slightly if at all inflated, at the base on both sides with a projection toward the center; sutures distinct, gently curved; wall smooth; aperture at the base of the last-formed chamber at the median line. Diameter of holotype 0.40 mm.; thickness 0.10 mm.

Holotype (Cushman Coll. No. 38214) from the Midway Eocene, Soldado formation, Soldado Rock, Trinidad, B. W. I. Coll. Dr. H. G. Kugler (sample K. 2950).

This species differs from *A. acuta* Plummer in the smooth, unornamented surface and the expansions at the base of the chambers. The peculiar structure at the base of the chambers is somewhat suggestive of *Astrononion* but the other characters seem to place it in *Anomalina*.

ANOMALINA sp. (Pl. 3, fig. 8)

The figured specimen is one of a series of a rather variable form which, from the material, is difficult to describe. It does not seem identical with any of the species described from the Midway. It is like some of the Tertiary forms that have been referred to *Anomalina grosserugosa* (Gümbel).

Genus *CIBICIDES* Montfort, 1808

CIBICIDES PRAECURSORIUS (Schwager) (Pl. 3, fig. 9)

Discorbina praecursoria SCHWAGER, Palaeontographica, vol. 30, 1883, Pal. Theil, p. 125, pl. 27 (4), figs. 12, 13; pl. 29 (6), fig. 16.

Cibicides praecursorius CUSHMAN and PONTON, Contr. Cushman Lab. Foram. Res., vol. 8, 1932, p. 72, pl. 9, fig. 14.—CUSHMAN and GARRETT, l. c., vol. 15, 1939, p. 88.—TOULMIN, Journ. Pal., vol. 15, 1941, p. 610, pl. 82, figs. 19-21.

Specimens of this species, one of which is figured, occur in the Soldado material. The other references to the species are mostly from the Wilcox Eocene of Alabama. Schwager's types were from the middle Eocene of Egypt.

CIBICIDES HOWELLI Toulmin (Pl. 3, fig. 10)

Cibicides cf. *pseudoungerianus* CUSHMAN and GARRETT, Contr. Cushman Lab. Foram. Res., vol. 15, 1939, p. 88, pl. 15, figs. 25, 26.

Cibicides howelli TOULMIN, Journ. Pal., vol. 15, 1941, p. 609, pl. 82, figs. 16-18.

A few specimens from the Soldado are close to this species from the Wilcox Eocene of Alabama. There is considerable variation in our specimens.

CIBICIDES cf. SEMIPLECTUS (Schwager) (Pl. 3, fig. 11)

Pulvinulina semiplecta SCHWAGER, Palaeontographica, vol. 30, 1883, Pal. Theil, p. 130, pl. 27 (4), fig. 16.

Cibicides semiplectus CUSHMAN and PONTON, Contr. Cushman Lab. Foram. Res., vol. 8, 1932, p. 72, pl. 9, figs. 12, 13(?).

The figured specimen from the Soldado is one of a series that seems close to this species known from the middle Eocene of Egypt and from the Wilcox Eocene of Alabama. The last-formed chamber in the figured specimen has not reached the full development that sometimes appears in this species.

CIBICIDES cf. WILLIAMSONI Garrett (Pl. 3, fig. 12)

Cibicides williamsoni GARRETT, Journ. Pal., vol. 15, 1941, p. 156, pl. 26, fig. 15.

The Soldado specimens are smaller than the autotypes of this species from the middle Eocene of southern Alabama and Mississippi but in essential characters seem to be closely related.

236. THE RECENT AND FOSSIL SPECIES OF *LATICARININA**

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By JOSEPH A. CUSHMAN and RUTH TODD

In a previous paper in these Contributions (vol. 17, 1941, pp. 103-105, pl. 24 [part]) we have discussed the structure and development of the type species of the genus *Laticarinina*. A further study has been made of all available material, fossil and Recent, of this genus as well as a study of the literature. The results are given below. The records would seem to indicate that the genus occurs as early as the Cretaceous but we have been unable to find specimens with the true generic characters earlier than the Miocene.

The new species described from off the Philippines is unique in the strong development of the keel, whereas the fossil species are as a rule more strongly plano-convex than Recent ones. The following species have been recognized.

Genus LATICARININA Galloway and Wissler, 1927

Genotype, *Pulvinulina repanda*, var. *menardii*, subvar. *pauperata* PARKER and JONES.

Test plano-convex, slightly trochoid, the dorsal side flattened,

ventral side convex, chambers composed of a larger ventral portion and a smaller flattened dorsal portion separated by a thin plate representing a continuation of the keel, a wide flange forming a carina around the periphery, aperture on the dorsal side at the inner margin of the last-formed chamber.

LATICARININA PAUPERATA (Parker and Jones) (Pl. 4, figs. 1-6)

Pulvinulina repanda, var. *menardii*, subvar. *pauperata* PARKER and JONES, Philos. Trans., vol. 155, 1865, p. 395, pl. 16, figs. 50, 51.

Pulvinulina pauperata H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 696, pl. 104, figs. 3-11; Quart. Journ. Geol. Soc., vol. 44, 1888, p. 10 (table).—PICAGLIA, Atti Soc. Nat. Modena, ser. 3, vol. 12, 1893, pp. 153, 155 (lists).—EGGER, Abhandl. kön. bay. Akad. Wiss. München, Cl. II, vol. 18, 1893, p. 412, pl. 17, figs. 32-34.—CHAPMAN, Proc. Zool. Soc. London, 1895, p. 42.—GOËS, Bull. Mus. Comp. Zoöl., vol. 29, 1896, p. 77.—FLINT, Ann. Rep. U. S. Nat. Mus., 1897 (1899), p. 330, pl. 74, fig. 3.—CHAPMAN, Journ. Linn. Soc. Zool., vol. 30, 1910, p. 423.—SCHUBERT, Verh. k. k. geol. Reichs., No. 14, 1910, p. 325; Abhandl. k. k. geol. Reichs., vol. 20, pt. 4, 1911, p. 112.—CUSHMAN, Bull. 71, U. S. Nat. Mus., pt. 5, 1915, p. 61, pl. 23, figs. 2, 3; Bull. 100, U. S. Nat. Mus., vol. 4, 1921, p. 340, pl. 68, fig. 2.—HERON-ALLEN and EARLAND, British Antarctic Exped., Zoology, vol. 6, 1922, p. 217.—KOCH, Ber. Schweiz. Pal. Ges., vol. 18, 1923, p. 357.—YABE and HANZAWA, Jap. Journ. Geol. Pal., vol. 4, 1925 (1926), p. 52.—CHAPMAN, New Zealand Geol. Surv., Pal. Bull. No. 11, 1926, p. 83, pl. 16, fig. 14.—KOCH, Ber. Schweiz. Pal. Ges., vol. 19, 1926, p. 728 (list).—NUTTALL, Quart. Journ. Geol. Soc., vol. 84, 1928, p. 100.—EARLAND, *Discovery* Rep'ts, vol. 7, 1933, p. 129.

Pellatispira pauperata CUSHMAN, Bull. Scripps Instit. Oceanography, Tech. Ser., vol. 1, No. 10, 1927, p. 176, pl. 6, fig. 13.

Laticarinina pauperata WIESNER, Deutsche Süd-Polar-Exped., vol. 20, Zool., 1929, p. 136.—CUSHMAN, Bull. 104, U. S. Nat. Mus., pt. 8, 1931, p. 114, pl. 20, fig. 4; pl. 21, fig. 1; Special Publ. No. 4, Cushman Lab. Foram. Res., 1933, pl. 28, fig. 4; Special Publ. No. 5, 1933, pl. 36, fig. 9.—HADLEY, Bull. Amer. Pal., vol. 20, No. 70A, 1934, p. 29, pl. 4, fig. 9.—EARLAND, *Discovery* Rep'ts, vol. 10, 1934, p. 188; vol. 13, 1936, p. 57.—CHAPMAN and PARR, Australasian Antarctic Exped., ser. C, vol. 1, pt. 2, 1937, p. 118, pl. 9, fig. 28.—ISHIZAKI, Taiwan Tigaku Kizi, vol. 10, No. 4, 1939, p. 117, pl. 9, figs. 15, 16.—LEROY, Nat. Tijdschr. Nederl.-Indie, vol. 99, pt. 6, 1939, p. 267, pl. 2, figs. 9, 10.—CUSHMAN and HENBEST, U. S. Geol. Survey Prof. Paper 196-A, 1940, pl. 10, fig. 16.—CORYELL and RIVERO, Journ. Pal., vol. 14, 1940, p. 333, pl. 42, fig. 33.—LEROY, Colorado School Mines Quart., vol. 36, No. 1, pt. 1, 1941, p. 46, pl. 2, figs. 18, 19; l. c., pt. 2, 1941, p. 88, pl. 6, figs. 30, 31.—CUSHMAN and TODD, Contr. Cushman Lab. Foram. Res., vol. 17, 1941, pp. 103-105, pl. 24, figs. 10-12.

Test plano-convex, slightly trochoid, the dorsal side flattened, the ventral side convex, composed of 2 or $2\frac{1}{2}$ whorls in the adult, surrounded by a usually transparent keel showing growth lines conforming with the re-entrant at the proximal margin of the keel in the young stage; chambers ranging from 12 or 13 in a megalospheric adult to 22 in a microspheric adult, early ones close coiled and nearly spherical, later ones becoming loosely coiled and cuneiform on the ventral side and reniform on the dorsal; sutures nearly radial on the ventral side but on the dorsal side the chambers are so separated that there are no distinct sutures; wall smooth, finely perforate, earlier chambers often with a thin inner wall of chitin; aperture on the dorsal side at the inner margin of the last-formed chamber, low and elongate, dorsal and ventral portion of each chamber connected by a sinus through the separating plate, and adjacent chambers connected by tubular necks on the ventral side.

The size of *L. pauperata* varies in different localities. In the Gulf of Mexico and Caribbean Sea we have found the largest specimens, averaging 1.5 mm. in diameter including the keel (0.9 mm. without) and 0.10 to 0.17 mm. in thickness. Our Pacific specimens are typically smaller, averaging 0.9 mm. in diameter with keel (0.5 mm. without).

The types of *L. pauperata* were from the North Atlantic, lat. $50^{\circ} 6' N.$, long. $45^{\circ} 45' W.$, 1,405 fathoms, and lat. $52^{\circ} 16' 30'' N.$, long. $29^{\circ} 28' 30'' W.$, 2,176 fathoms. The species has since been widely recorded, both fossil and Recent. In the present oceans records include the following:

In the North Atlantic Brady recorded it from 12 stations and stated that its northern limit appeared to be about $56^{\circ} N.$ It was also recorded at the top of one of the cores about halfway between Newfoundland and Ireland (Cushman and Henbest), and from one station off Morocco (Picaglia). Cushman recorded it from 8 stations in the Gulf of Mexico and Caribbean Sea and 2 stations off the southeastern coast of the United States. Goës and Flint have also recorded it from this region and we have found specimens from a number of additional stations in the same region. It has been recorded from 4 stations in the South Atlantic (Brady) and from off Brazil (Cushman). Of the Pacific records most are in the western part. Brady recorded it from one station in the North Pacific and 10 stations in the South Pacific.

Goës recorded it from the Pacific, Cushman from off the Galapagos Islands, and Picaglia from 2 stations in the eastern Pacific. We have 3 specimens from *Albatross* II 2751 between California and Hawaii. In the western part of the Pacific Chapman recorded it from 7 stations around Funafuti, noting "examples rather small." Cushman recorded it from many *Nero* stations between Guam and Japan and in waters adjacent to the Philippines. Yabe and Hanzawa recorded it as very rare at one station between Japan and the Philippines. Brady recorded it from 2 stations in the "Southern Ocean." In the Indian Ocean it has been recorded as rare from one station near New Amsterdam Island (Egger), and from a number of soundings in the Arabian Sea near the Laccadive Islands (Chapman). It has been recorded near Tasmania (Chapman and Parr), from the east coast of New Zealand and the west side of the Ross Sea (Heron-Allen and Earland), from the Falklands sector of Antarctica and the eastern side of Weddell Sea (Earland), and from the part of Antarctica south of the Indian Ocean (Wiesner). Its southernmost record is 71° 22' S. Most of these Recent records are in deep water.

As a fossil species *L. pauperata* has been recorded from the "Post-Tertiary" soapstone of Suva, Fiji (Brady); from the youngest Tertiary of the Bismarck Archipelago (Schubert); frequent in the late Tertiary of Kabu, Java (Koch); very rare in the late Miocene or early Pliocene of Sangkoelirang Bay, East Borneo, and Siberoet Island, N. E. I., and from the Miocene of the Goenoeng Toea area, Telisa, Central Sumatra (LeRoy); from the middle Tertiary of Bulongan, East Borneo (Koch); from the middle Miocene of Kwansai, Sintiku Prefecture, Taiwan (Ishizaki); from the upper middle Miocene at Port-au-Prince, Haiti (Coryell and Rivero); from the Tertiary of the Naparima region of Trinidad (Nuttall); from the Oligocene, "probably upper," of Marel, Pinar del Rio Province, Cuba (Hadley); from the upper Eocene, grey marls, of Weka Creek, New Zealand, by Chapman who records it as large and common, and also in the Upper Cretaceous, Chalk, of Oxford, North Canterbury, New Zealand, as small but typical. We have been unable to find typical *L. pauperata* as fossil in any material which we have examined.

The distribution in the present oceans is very wide and would indicate that the species may probably be attached to floating

seaweeds. Some of our specimens have opaque areas, apparently of attachment, on the dorsal side. Occasionally specimens of *Ammolagena* are found attached to *Laticarinina* in any haphazard position, but the scar shown on pl. 4, fig. 4 *a* is typical in area and position of scars occurring on a number of adult specimens. A study of the localities outside the tropics would suggest a floating habitat, as the localities farthest north and south from which *Laticarinina* is recorded are in the paths of warm rather than cold currents. The keel and chamber walls of some specimens are perforated by tubules and cells. These structures apparently are not an integral part of the test as formed by the animal itself, but are due to some outside cause, possibly parasites. The number and type of tubules varies greatly in different specimens. Two examples are shown on pl. 4, figs. 4 and 5.

LATICARININA CRASSICARINATA Cushman and Todd, n. sp. (Pl. 4, figs. 11, 12)

Pulvinulina pauperata CUSHMAN (part), Bull. 100, U. S. Nat. Mus., vol. 4, 1921, p. 340.

Test large, about equally plano-convex, much compressed, with a wide peripheral keel, much thickened, and overlapping the chambers, in some specimens almost entirely covering the chambers on the ventral side, with numerous tubules and cellular openings making the keel opaque and granular; chambers numerous, as many as 26 in microspheric specimens, narrowly wedge-shaped on the ventral side in the adult; sutures depressed; wall of the chambers smooth, finely perforate; aperture low, elongate, on the dorsal side.

Diameter of holotype 2.25 mm. with keel, 1.40 mm. without keel; thickness 0.32 mm.

Holotype (Cushman Coll. No. 38220) from Albatross D 5236, from 494 fathoms, east coast of Mindanao, Philippines, lat. 8° 50' 45" N., long. 126° 26' 52" E., surface temp. 85° F., bottom temp. 41.2° F.

This species differs from *L. pauperata* (Parker and Jones) in the more numerous, high, and narrower chambers, and especially in the greatly thickened, opaque keel, which is often thicker than the rest of the test and may entirely cover the ventral side. Specimens are fairly common at the type locality.

Occasional specimens from the Caribbean show a tendency toward a slight thickening of the keel but only suggestive of the development in the Philippine material.

LATICARININA CARINATA (Galloway and Wissler) (Pl. 4, fig. 7)

Carinina carinata GALLOWAY and WISSLER, Journ. Pal., vol. 1, 1927, p. 51, pl. 9, fig. 3.

"Test attached to plants in life, plano-convex, provided with a very broad, thin flange with a rounded keel; chambers arranged in two whorls, globular, scarcely touching, separated by deep sutures, those in the last whorl provided with a slight tubercle of clear shell material; wall hyaline; aperture a small slit where the flange on the last chamber joins the flange of the previous whorl. Diameter of the type specimen, 0.80 mm."

The type is from the Pleistocene, lower bed in the Lomita Quarry, Palos Verdes Hills, California, where the species is recorded as "very rare." A topotype specimen is figured.

LATICARININA ANGUSTATA Coryell and Rivero (Pl. 4, fig. 10)

Laticarinina angustata CORYELL and RIVERO, Journ. Pal., vol. 14, 1940, p. 333, pl. 43, fig. 15.

"Test of moderate size for the genus, compressed and keeled, with later chambers inflated; early chambers closely appressed but apparently not involute, later ones loosely appressed; chambers increasing in height, the last one forming about one-third of the test; early sutures covered with a few thick beads of shell material, the latter ones nearly flush with the sutures, the last two chambers very much inflated between the sutures; the apertural face of the last chamber is broken. Length, 0.75 mm.; width, 0.56 mm.; thickness, 0.27 mm."

The types are from the upper middle Miocene at Port-au-Prince, Haiti.

We have found no specimens referable to this species in the material we have examined.

LATICARININA BULLBROOKI Cushman and Todd, n. sp. (Pl. 4, figs. 8, 9)

Test plano-convex, the dorsal side flattened, the ventral side strongly convex, composed of $2\frac{1}{2}$ whorls in the adult, with a wide, thin, transparent keel, the last few chambers tending to become distinctly separated from the earlier ones in the adult; chambers up to 20 in number, the earlier ones conical on the ventral side, becoming relatively less high as development progresses; sutures depressed, especially on the ventral side; wall smooth, finely perforate; aperture on the dorsal side at the inner margin of the last-formed chamber, low and elongate.

Diameter of holotype 1.12 mm. with keel, 0.75 mm. without keel; thickness 0.20 mm.

Holotype (Cushman Coll. No. 38222) from U. S. G. S. Loc. 8986, Miocene, *Globigerina* clay, 500 yards south of 11 miles, 20 chains of Rock-Penal Road, Trinidad, B. W. I. J. A. Bullbrook, coll.

This species differs from *L. pauperata* (Parker and Jones) in having more narrowly wedge-shaped chambers and in being more loosely coiled in the adult. The young stages of the species are most like *L. carinata* (Galloway and Wissler) from the Pleistocene of California but the chambers are less sharply pointed. Extreme megalospheric forms do not have the early conical chambers, which are shown best in microspheric forms.

A very similar, perhaps identical, species occurs in some numbers at *Albatross* D 2144 at 896 fathoms in the Caribbean Sea off Panama, lat. 9° 49' 00" N., long. 79° 31' 30" W.

RECENT LITERATURE ON THE FORAMINIFERA

Below are given some of the more recent works on the foraminifera that have come to hand:

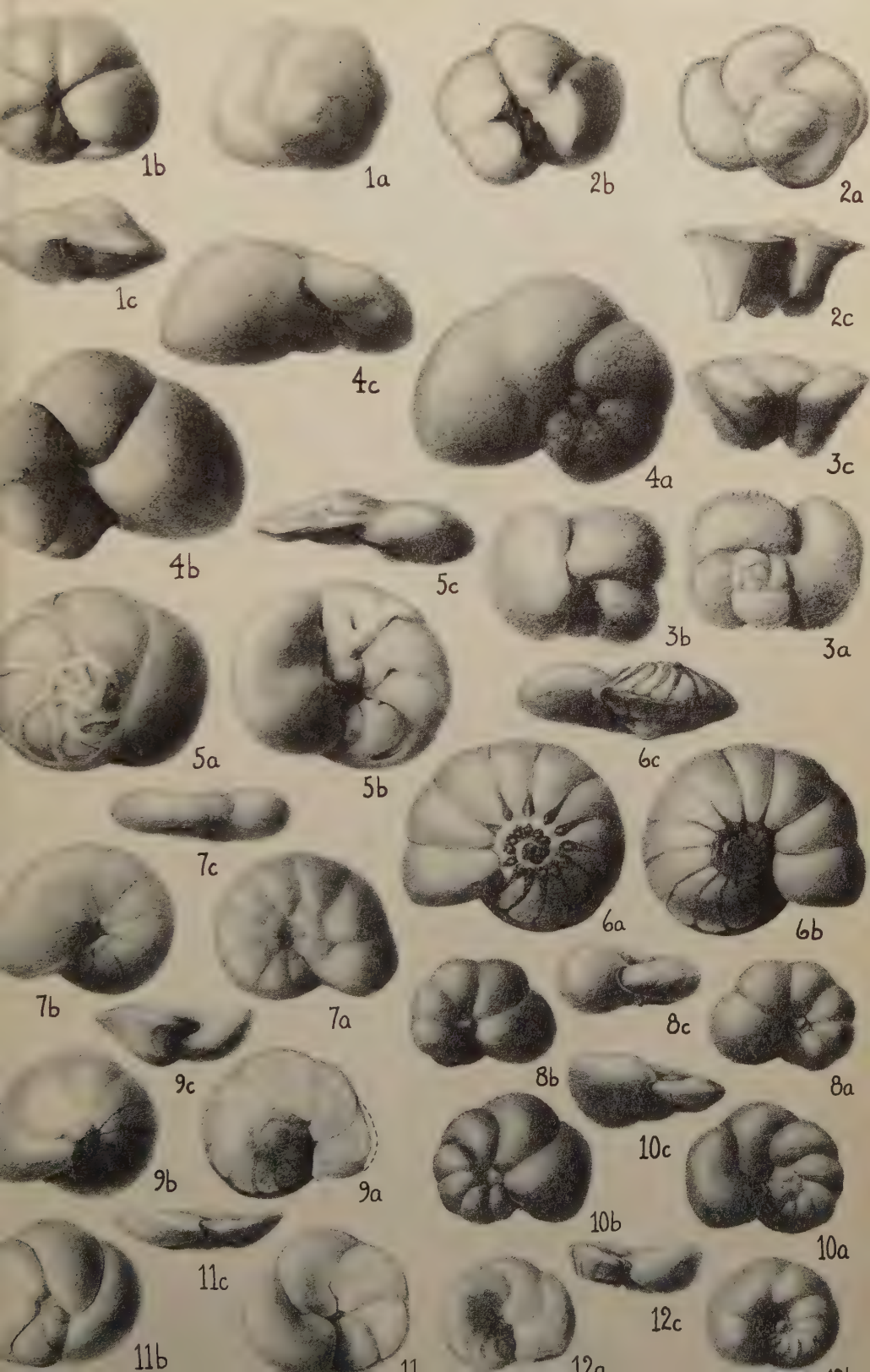
Crespin, Irene. The Genus *Cycloclypeus* in Victoria.—Proc. Roy. Soc. Victoria, vol. LIII, pt. II (New Series), July 26, 1941, pp. 301-314, pls. XII-XV, text figs. 1-4.—A systematic study of the genus is given, and the following described and figured: *Cycloclypeus victoriensis*, n. sp., var. *gippslandica*, n. var.

EXPLANATION OF PLATE 3

(All figures $\times 70$)

FIG. 1. *Eponides elevata* (Plummer). 2. *Globorotalia wilcoxensis* Cushman and Ponton, var. *acuta* Toulmin. 3. *Globorotalia crassata* (Cushman), var. *aequa* Cushman and Renz, n. var. Holotype of variety. 4. *Discorbis midwayensis* Cushman, var. *soldadoensis* Cushman and Renz, n. var. Holotype of variety. 5. *Discorbis midwayensis* Cushman, var. *trinitatensis* Cushman and Renz, n. var. Holotype of variety. 6. *Anomalina acuta* Plummer. 7. *Anomalina basilobata* Cushman and Renz, n. sp. Holotype. 8. *Anomalina* sp. 9. *Cibicides praecursorius* (Schwager). 10. *Cibicides howelli* Toulmin. 11. *Cibicides* cf. *semiplectus* (Schwager). 12. *Cibicides* cf. *williamsoni* Garrett.

In all figures: *a*, dorsal view; *b*, ventral view; *c*, peripheral view.





- Croneis, Carey. Micropaleontology—Past and Future.—Bull. Amer. Assoc. Petr. Geol., vol. 25, No. 7, July, 1941, pp. 1208-1255, text figs. 1-16.—The history of work on the foraminifera is given with that of other micropaleontologic groups.
- Lalicker, C. G. and P. J. Bermudez. Some Foraminifera of the Family Textulariidae Collected by the First "Atlantis" Expedition.—Torreia, No. 8, Sept. 27, 1941, pp. 1-19, pls. 1-4.—Twenty-one species and varieties are described and figured, three new: *Bigenerina lytta*, n. sp.; *B. perna*, n. sp.; *Textularia sica*, n. sp.
- DeWitt Puyt, J. F. C. Geologische und Paläontologische Beschreibung der Umgebung von Ljubuski, Hercegovina.—Diss. Utrecht, 1941, pp. 1-99, pls. I-V.—Many species, especially from the Eocene, are tabulated, and many of them described and figured, the following new: *Textularia dalmatina*, n. sp.; *Cristellaria (Robulus) umbonata* (Reuss), var. *dalmatina*, n. var.; *Vaginulina dalmatina*, n. sp.; *Hydromylinia*, n. gen.; *H. rutteni*, n. sp.; *Angulogerina liebusi*, n. sp.; *Eponides carolinensis* Cushman, var. *dalmatina*, n. var.; *Rectoeponides dalmatina*, n. sp.; *Cymbalopora dalmatina*, n. sp.; *Cibicides cryptomphalus* (Reuss), var. *herzegovinensis*, n. var.
- Cushman, Joseph A. and Irene McCulloch. Some Virguliniinae in the Collections of the Allan Hancock Foundation.—Allan Hancock Pacific Expeditions, vol. 6, No. 4, Jan. 19, 1942, pp. 181-230, pls. 21-28.—Four genera represented by forty-nine species and varieties are described and figured, eight new as follows: *Bolivina acerosa* Cushman, var.

EXPLANATION OF PLATE 4

(All figures except 10, $\times 26$; 10, $\times 33$)

FIGS. 1-6. *Laticarinina pauperata* (Parker and Jones). 1, 3, 4, Sta. 93, Johnson-Smithsonian Expedition, lat. $18^{\circ} 38' 00''$ N., long. $65^{\circ} 09' 30''$ W. 350-400 fathoms. 2, *Albatross* D 2377, lat. $29^{\circ} 07' 30''$ N., long. $88^{\circ} 08' 00''$ W. 210 fathoms. 5, Sta. 25, Johnson-Smithsonian Expedition, lat. $18^{\circ} 32' 15''$ N., long. $66^{\circ} 22' 10''$ W. 240-300 fathoms. 6, *Nero* Sta. 1415, lat. $21^{\circ} 46' 30''$ N., long. $144^{\circ} 02' 00''$ E. 1300 fathoms. 1, Young microspheric form. 2, Megalospheric adult. 3, Microspheric adult showing supplementary and malformed chambers. 4, Microspheric adult showing tubules and cells represented by lighter areas in the keel and the wall of the chambers, and scar of probable attachment on the dorsal side. *a*, dorsal view; *b*, ventral view; *c*, peripheral view. 5, Megalospheric form with much coarser and branching tubules in the keel. 6, Microspheric form showing opaque keel. 7. *L. carinata* (Galloway and Wissler). Topotype. 8, 9. *L. bullbrookii* Cushman and Todd, n. sp. 8, Holotype. *a*, dorsal view; *b*, ventral view; *c*, peripheral view. 9, Young. U. S. G. S. Sta. 9210, washings from sandy *Globigerina* marls from Moriquite River, near head, west of old Marac Trace, Trinidad, B. W. I. Bullbrook, collector. *a*, ventral view; *b*, peripheral view. 10. *L. angustata* Coryell and Rivero (after Coryell and Rivero). 11, 12. *L. crassicarinata* Cushman and Todd, n. sp. 11, Holotype. *a*, dorsal view; *b*, ventral view; *c*, peripheral view. 12, Paratype. Young.

pacifica, n. var.; *B. quadrata*, n. sp.; *B. seminuda* Cushman, var. *humilis*, n. var.; *B. tongi* Cushman, var. *filacostata*, n. var.; *B. torqueata*, n. sp.; *Loxostoma instabile*, n. sp.; *Bifarina hancocki*, n. sp.; *B. pacifica*, n. sp.

Cushman, Joseph Augustine. The Foraminifera of the Tropical Pacific Collections of the "Albatross," 1899-1900, Part 3. Heteroheliciidae and Buliminidae.—U. S. National Museum Bull. 161, pt. 3, 1942, pp. I-V, 1-67, pls. 1-15.—Sixty-eight species and varieties belonging to the two families are described and figured and tables of their distribution with data as to depth, temperature, etc., given.

Patterson, Joseph M. Stratigraphy of Eocene between Laredo and Rio Grande City, Texas.—Bull. Amer. Assoc. Petr. Geol., vol. 26, No. 2, Feb., 1942, pp. 256-274, 3 figs.—Mentions a few index species of foraminifera.

J. A. C.

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